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Dahlgreen Creek Test Evaluated

by Howard R. Ritzma*

The February 1968 *Quarterly Review* featured a geologic section depicting the startling geology then revealed by Shell Oil's No. 1 Dahlgreen Creek test well, SE NE NW Section 9, T. 2 N., R. 14 E., Summit County. At that time, Shell was drilling slowly at about 4,500 feet.

Months went by and bits ground steadily deeper. The geology became more confusing and puzzling. By September, at a total depth of 17,100 feet, the well had penetrated the objective, the Dakota Formation, and topped the Jurassic Morrison Formation.

Encouraging oil shows were found in the Dakota, and, for a time, it seemed No. 1 Dahlgreen Creek might become the discovery well of Summit County's second oil field.

However, the 50 or so feet of oil-stained sandstone scattered through the Dakota section could not be coaxed into production. The well was abandoned in October 1968. Drilling costs exceeded $1 million.

The 17,100-foot depth was the length of a very crooked hole. The well apparently bottomed (mountainward beneath the fault overhang) nearly half a mile south of the surface location and at a level about 16,700 feet below the ground elevation.

Between the 4,500-foot depth shown in the section of February 1968 and total depth, Shell's geologic interpretation of the well underwent continuing

(Continued on page 2)

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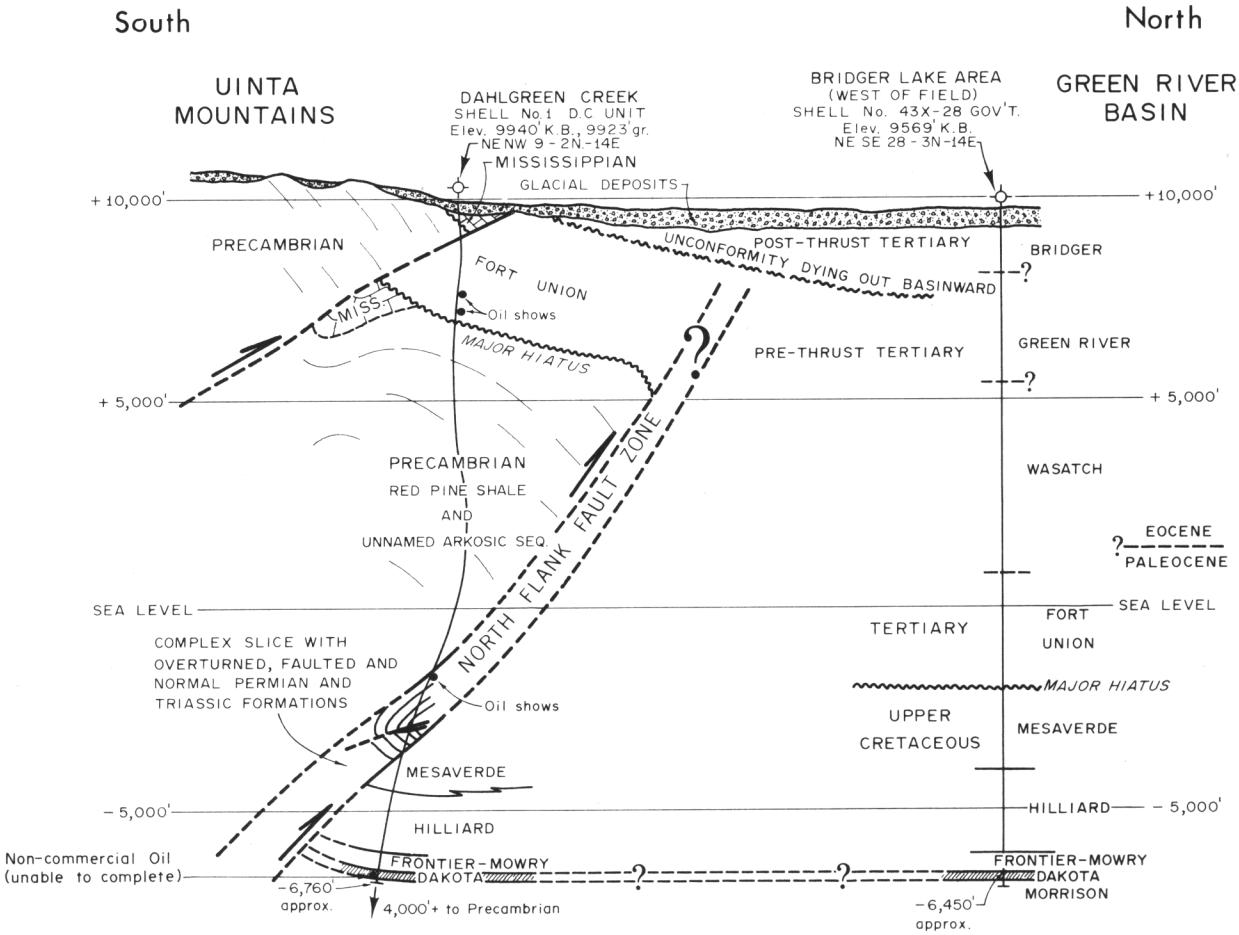


SOUTH-NORTH CROSS SECTION
DAHLGREEN CREEK-BRIDGER LAKE AREA
Ts. 2 & 3 N., R. 14 E., SUMMIT COUNTY, UTAH
HORIZONTAL AND VERTICAL SCALES EQUAL

(Continued from page 1)

revision and reappraisal. Drilling 8,790 feet of Precambrian basement formation required considerable corporate stamina.

With most pertinent data at hand (thanks to Shell and cooperating companies), the Utah Geological Survey presents its current preferred interpretation of the geology revealed by this most interesting, significant test.

The well logged the following topsy-turvy section:

Surface-445? —Glacial deposits
445-490 —Mississippian limestone
490-820 —Red Pine Shale? (Precambrian)

Thrust fault (Major)

820-2,940 —Fort Union Formation (Tertiary, Paleocene)

Probable unconformity

2,940-11,730 —Red Pine Shale and unnamed arkosic sequence (Precambrian)

Thrust fault (Major)

11,730-11,800—Phosphoria Formation (Permian)—overturned
11,800-12,280—Moenkopi Formation (Triassic)—overturned
12,280-12,575—Thaynes Limestone (Triassic)—overturned
12,575-12,865—Shinarump Conglomerate (Triassic)—overturned
12,865-13,160—Nugget Sandstone (Triassic-Jurassic)—overturned

Fault

13,160-13,290—Shinarump Conglomerate (Triassic)—normal

Fault?

13,290-13,440—Nugget Sandstone (Triassic-Jurassic)—normal
13,440-13,560—Shinarump Conglomerate (Triassic)—normal
13,560-13,813—Moenkopi Formation (Triassic)—normal

Thrust fault (Major)

13,813-14,840—Mesaverde Formation (Upper Cretaceous)
14,840-16,330—Hilliard Shale
16,330-16,475—Frontier Formation
16,475-16,790—Mowry Shale
16,790-17,048—Dakota Formation (Lower Cretaceous)
17,048-17,100—Morrison Formation (Jurassic)

Formations below 13,813 feet appeared to be in a normal, undisturbed sequence, except for a small decrease in Hilliard Shale thickness.

The accompanying section may not please all concerned and is certainly not to be considered a final version. There are many unknown and uncertain factors involved that can only be assumed and surmised. Understandably, there is much regional geologic information derived from seismic surveys that must remain in closed company files. *Of course, publishing the section does not imply either agreement or disagreement with this geologic interpretation by Shell Oil or cooperating companies in the Dahlgreen Creek Unit.*

Data from the well suggest the following sequence of structural events in this area:

—Late Cretaceous and Paleocene uplift in the vicinity of the western Uinta Mountains caused the Paleocene (Fort Union) to rest unconformably on the Precambrian core of the range. The unconformity is probably the same as that responsible for a hiatus between Cretaceous and Tertiary along the buried Moxa-Church Buttes Arch beneath the Green River Basin and elsewhere in southwest Wyoming. Thus, the unconformity is probably not an exclusive feature of Uinta tectonics.

—Northward thrusting of the Uintas displaced the Fort Union and the Wasatch (Paleocene-Eocene), but probably is overlapped by Green River? and Bridger? (post-fault Eocene). This tectonic episode corresponds in time with the major uplift of the mountain range recorded elsewhere in northeast Utah and northwest Colorado. The root zone of the thrusting apparently lies at great depth beneath the ruptured flank of the Uinta Mountain Arch.

—Possibly younger thrusting carried Paleozoic and Precambrian over the older fold and fault complex. This thrusting may be younger, or it may be part of the older faulting with the leading edge effaced by erosion.

One matter of scientific importance seems settled — the nature of the North Flank Fault (or Faults). The boundary of the Uinta Mountain uplift is a zone of reverse faulting, possibly of low enough angle (less than 45°) to be classified as a thrust.

There may be two thrusts of varying age as shown in the accompanying section, but other interpretations can be constructed that eliminate one fault entirely or combine two into one system of branching faults.

Complex geology, difficult drilling, crooked hole problems, rough terrain and severe winter weather combined to make Dahlgreen Creek No. 1 a geological and engineering achievement worthy of note. Shell Oil Co., other cooperating companies in the Dahlgreen Creek Unit, and the Loffland Brothers Drilling Co. are to be commended on a tough, often frustrating, job well done.

These difficulties and the great expense involved will undoubtedly act as a deterrent to further extensive testing of petroleum possibilities to the south beneath the North Flank Fault, particularly in the rugged mountainous terrain. Based on present technology and economics, petroleum possibilities, *undoubtedly present,* appear to be elusive.

We also wish — undoubtedly along with others — that the well had been a commercial success as well.

Mobil "Bomb" — A Scientific Success

Last September, Mobil Oil Corp. drilled, plugged, and abandoned its No. 1 Antelope Flat prospect (SE SE NE Sec. 35, T. 3 N., R. 22 E.) in Daggett County.

The test was devoid of oil shows but significant, all the same. *It established the plane of overthrusting to be about 45°, and proved beyond doubt the reverse nature of the Uinta Fault in this area.*

In short, as one Mobil spokesman noted, the well was a "commercial 'bomb,' but a scientific success."

The No. 1 Antelope Flat was spudded in Precambrian Uinta Mountain Quartzite approximately 1,500 feet south of the surface trace of the Uinta Fault, 2 miles north of the town of Dutch John, and about 3 miles from Flaming Gorge Dam.

At a depth of 1,510 feet, the well crossed the Uinta Fault and penetrated a slice of Paleozoic limestone; at 1,605 feet, it entered Weber Sandstone (Pennsylvanian); and at total depth, 2,047 feet, it bottomed in the Morgan Formation, also Pennsylvanian.

Mobil drilled its No. 1 Antelope Flat prospect 45 miles east of Shell's No. 1 Dahlgreen Creek Unit test, and the two geologic situations appear to be parallel.

Slips Showing

by Bruce N. Kaliser*

Italy's shocking Vaiont Dam tragedy, the worst disaster of its kind in history, was triggered by a massive landslide — and not by an inherent weakness in either the structure or the foundation.

On Oct. 9, 1963, six hundred million tons of rock from Mt. Toc poured into Vaiont Reservoir, sending 800-foot waves over the top of the world's highest, thin-arch dam.

In almost less time than it takes to tell it, the mountain of water claimed the town of Longarone and its population of more than 2,000 people.

The fate of Longarone tragically emphasizes the need for geologic investigations of slopes bordering reservoirs as well as of dams and the reservoir areas themselves. Slope material should be examined in situ, and its deformation capability assessed. Time is a dimension that must be taken into consideration also, since time could be the critical factor in failure.

For the past few years, the U.S. Bureau of Reclamation has made reservoir landslide studies part of its periodic review of the safety of its dams.

But, the Bureau appears to stand alone in this respect. Other agencies monitor their dams and structures, but not slope conditions in the vicinity of their reservoirs.

It's heartening to be able to say that some agencies intend to remedy the oversight.

Pine View Reservoir in Ogden Canyon is one place in the State of Utah where slope failures have gone almost unnoticed.

The slides occur on steep slopes bounding the narrow, neck-like portion of the reservoir that extends for about 1 mile above the dam.

Depths of failure planes are undetermined, but if they extend beneath the road shoulder bench that skirts the reservoir, *a first class hazard exists.*

*Engineering geologist, Utah Geological Survey.

We Didja Dirt!

As published, the retouched photograph at the top of Page 7 of the November 1968 *Quarterly Review* left something to be desired.

The brushwork was intended to emphasize the northwest dip of beds in the vicinity of a major slide.

That it didn't merely indicates our instructions to the artist (the best anywhere) were not clear.

We goofed, and we apologize.

Pine View Reservoir showing slope failure on north side.

Even if the failure is superficial, there is still a risk involved. Debris could be swept into the aqueduct intake.

The zone of failure at Pine View Reservoir is coincident with the outcrop of Precambrian Mineral Fork Formation, which in that area is thrust upon Mississippian limestones. Inherently weak, the Mineral Fork metasediments, particularly the phyllites, possess a low-shearing resistance.

Rock units that participated in the thrust have been fractured and deformed, and resultant movement along bedding planes has weakened frictional bonds.

Moreover, canyon walls, oversteepened by road cuts, harbinger viscoelastic, gravitational creep and sliding.

In short, the rock and soil mass at Pine View Reservoir constitutes a slope-stability problem.

Because of the tremendous amount of potential energy stored in a rock and soil mass on an incline, all slopes alongside reservoirs should be considered potential hazards — unless proven otherwise.

Geologic field investigations of slopes bordering planned or existent reservoirs can be a factor in preventing release of this destructive energy.

Report, Quad Map Now on Open File

A U.S. Geological Survey map and a Utah Survey report of investigation have been placed on open file.

The USGS preliminary uncolored geologic map of the Park City East quadrangle, Summit and Wasatch Counties, Utah, was prepared by Calvin S. Bromfield and Max D. Crittenden.

Drawn to a scale of 1:24,000, the map clearly identifies all geologic formations and structural features throughout an area that extends 7 miles north, 1 mile south and 6 miles east of the village of Park City.

The map is a compilation of work performed during the field seasons of 1961 and 1963-67.

It can be inspected at the offices of the Utah Survey, 103 Geological Survey Building, University of Utah, or studied and reproduced at 8102 Federal Office Building, Salt Lake City.

Utah Survey Report of Investigation No. 38, "Engineering Geology of the Victory Road Reservoir Site, Salt Lake City, Utah," by Bruce N. Kaliser, points out problems of a geologic nature that exist at the Victory Road Reservoir site.

Numerous photographs and a geologic map are included.

The 15-page report has been submitted to Salt Lake's Engineering and Water Department authorities. Hopefully, it will serve an immediate need and, at the same time, stress the ever-increasing importance of on-site geological investigations when civic works are planned.

Figure A

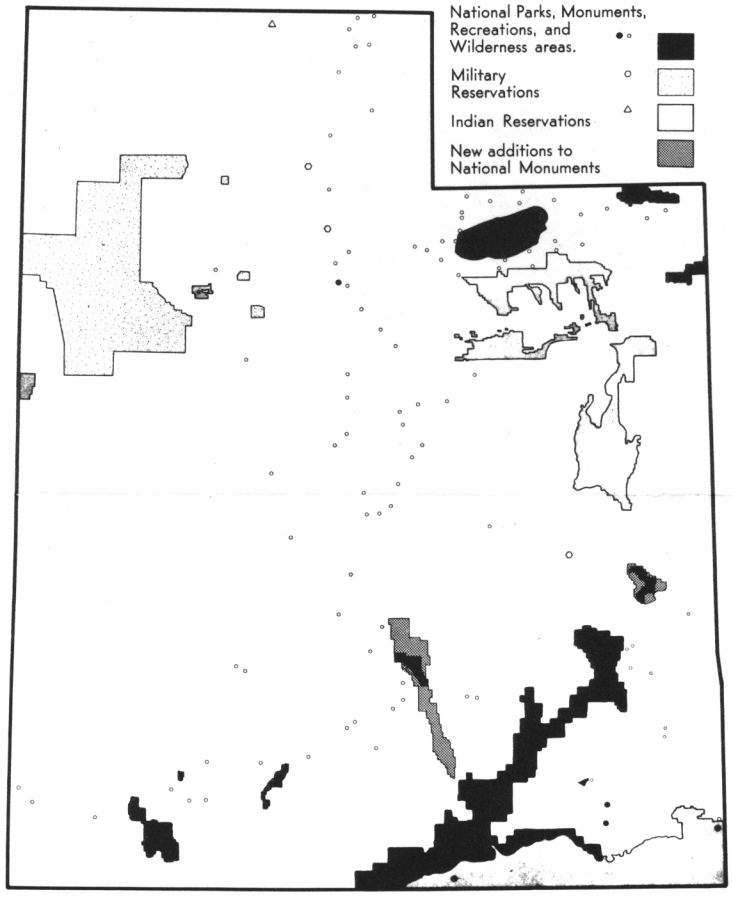


Figure B

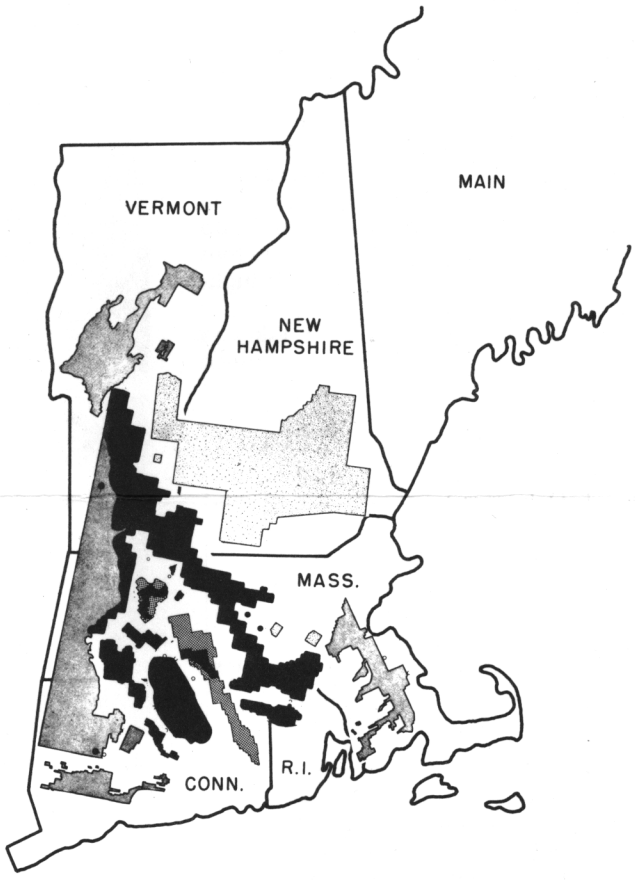
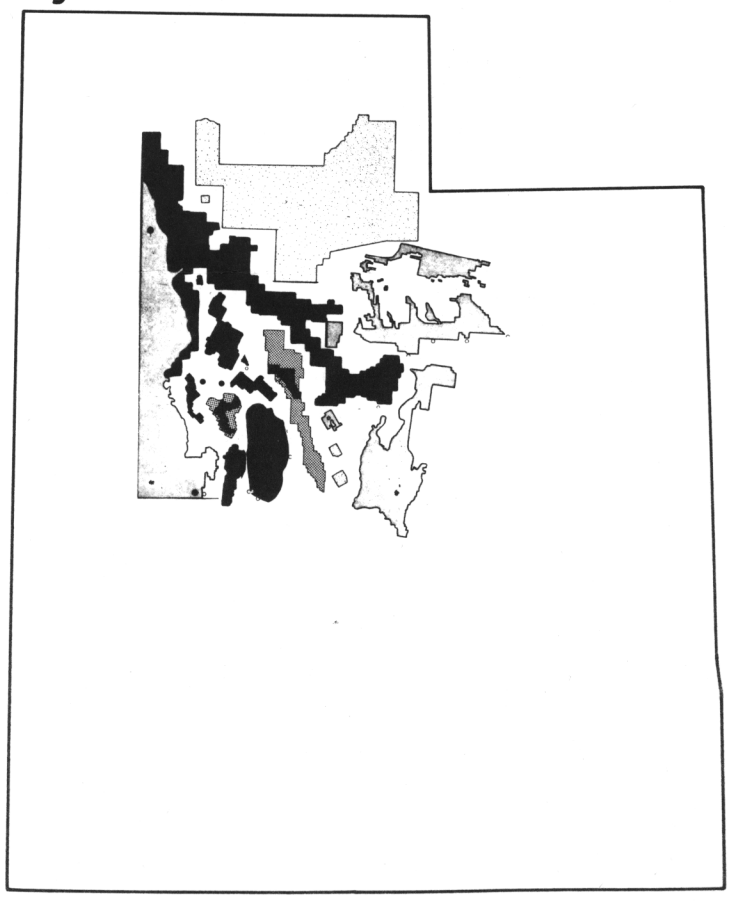


Figure C



LAND GRAB PIRATES

264,000-ACRE BOOTY?

by Hellmut H. Doelling*

On the 20th of January President Lyndon B. Johnson signed Proclamations 3887 and 3888, enlarging the Capitol Reef and Arches National Monuments in Utah by a total of approximately 263,999 acres.

To refresh our memories, *this amounts to 412.5 square miles or about 11.5 townships — an area equal to 39 percent of Rhode Island's land area.*

Most of the land withdrawn from the Public Domain was under the jurisdiction of the Bureau of Land Management, but about 42 square miles of Utah State lands also fell by the wayside.

Those who support ex-President Johnson's action contend that the lands withdrawn from public, private, or State ownership still belong to the public. We suggest this is not the case.

By law 37½ percent of the rentals and royalties collected from Federal Lands are returned to the State and county of origin. These returns are earmarked by the State for education and by the county for road development.

In the first half of 1968, the Federal Mineral Leasing Fund returned $1,499,000 to Utah, and the total for 1968 is expected to be about $3,000,000. To a State falling behind in its expenditures for education, this is important money.

Areas indicated in Figure A, which include those areas newly withdrawn, now are locked up with respect to mineral

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development, and such monies are no longer available to Utah.

Certainly, we do not object to National Parks and Monuments — but we do protest large withdrawals (take another look at Figure A) that exempt an area from mineral exploration and development and so eliminate a potential source of revenue.

Eventually, State lands will be exchanged, but normally this is a lengthy process.

Indian reservation lands are open to mineral development, but the money is returned to the reservation and not to the State. Theoretically, minerals can be exploited on military reservations, but imagine the improbability of developing mineral values while military operations, such as bombing, strafing, missile testing, and chemical and biological warfare tests, are being carried out.

Preservation groups currently are campaigning for other large tracts of land to form new wilderness and recreation areas. (One brochure mentions a parcel of land about the size of Delaware.)

Such groups oppose any kind of development on this land — even roads. Mineral potential is ignored. They maintain proposed areas have not produced vast amounts of minerals and therefore are no great economic loss, and that revenue derived from tourist trade will more than make up for this.

Several facts refute these contentions:

—Technologies change and improve, often making formerly worthless deposits valuable;

—In order to attract the kind of tourists whose dollars would substantially affect the financial situation of southern Utah, the area must be made accessible.

Establishment of wilderness areas invites only a small percentage of the tourist trade; most visitors cannot afford to rent the horses, planes and guides needed in this country.

The few that take advantage of it, enjoy camping out. They avoid motels and restaurants, and buy their groceries in large metropolitan areas where supplies are priced lower than the local merchant could afford to sell them.

Many Utah towns now take in about twice as much money from mineral developers (seismic crews, geologists, and engineering crews) as from tourists.

In one of the withdrawals just enacted, Utah lost half of a high-potential (500-million barrel) oil-sand deposit, several potentially productive uranium mines, and some less important coal and gypsum deposits.

The recent withdrawals are in southern Utah, where there is scarcely enough industry to sustain the present population.

But this country is the southern Utahn's birthright, the place in which he would like to see his children live. He can't afford to have any more areas of high-economic potential closed to development.

However, if the area is to be sacrificed for tourists, we whole-heartedly recommend full development — roads, playgrounds, marinas, picnic tables, the whole kit and caboodle.

We firmly believe in conserving natural resources, but we also believe in full development without waste. When an area is preserved, mineral resources are wasted. It is argued that in times of emergency these could be extracted, *but those familiar with the mineral industry know it takes years to develop deposits.*

Mineral development and natural beauty are not incompatible. In recent years, some companies have even improved the looks of areas in which they have worked.

Perhaps more Utahns would appreciate the immensity of the problem, if all withdrawn lands were arranged as shown in either Figure B or C. Withdrawal of the lands shown in the two figures would result in financial chaos for those areas involved.

It is producing consternation in southern Utah.

Analyses Donated

Utah Portland Cement has analyzed 21 limestone samples collected during the Utah Survey's Bear Lake environmental geology study last summer. The company's contribution has been significant.

Bruce N. Kaliser, UG&MS engineering geologist, assisted by the Economic Geology Division, is conducting the survey at the request of the Rich County Commission.

The study includes an inventory of all economic materials existent in the area. Carbonate rocks comprise most of the Paleozoic column and a good part of the Mesozoic column in this part of Utah.

Quarterly staff: Gladys V. Isakson, editor; Paula Young, assistant; Gordon Keller, Ann Allen, Terry Talcott and Sharon Monson; Roger Holland, critical reader.

SURVEY SPEAKERS ADDRESS AAPG

When the Rocky Mountain Section, American Association of Petroleum Geologists met recently in Albuquerque, N. M., two UG&MS-sponsored speakers were on the agenda.

Joe L. Bowman, Federal Resources, Newcastle, Wyo., discussed the oil-impregnated sandstones of the Tar Sand Triangle, bordered by the Dirty Devil, the Colorado, and the Green Rivers in Garfield and Wayne Counties, Utah. Mr. Bowman mapped the extensive deposits for the Utah Survey during the summer of 1968.

To promote interest in petroleum exploration, Howard R. Ritzma, reviewed the "Petroleum Potential of Utah." Mr. Ritzma currently chairs the Utah Field Names Advisory Committee.

Novel Fossil Finds

Fossil finds, thought to be the first of their kind in Utah, have been reported by Dr. R. W. Moyle, Weber State College, and Earl P. Olson, U.S. Forest Service.

The men made their discoveries last September while collecting in the Soldier Canyon type section of the Manning Canyon Formation.

Dr. Moyle collected nine specimens of the Paleozoic echinoderm, *Pentremites,* from Chester age rocks. While the tiny blastoid quite commonly is found in midcontinent rocks of Late Mississippian age, prior to Dr. Moyle's find it had been associated with Middle Mississippian sediments in Utah.

Mr. Olson took the bryozoan, *Archimedes,* from Unit 5 of the Dry Lakes section of Williams. So far as is known, this is the first time specimens of *Archimedes* have been recovered from northern Utah rocks.

MINERAL PRODUCTION IN UTAH BY COUNTY, 1966-1967

Compiled from U.S. Bureau of Mines data

Annual value of mineral output in Utah rose from $354.5 million in 1967 to $423.6 million in 1968 — a 19 percent increase — according to the U.S. Bureau of Mines.

Even so, the 1968 value was $25.3 million less than 1966's record high of $448.9 million.

In 1967, Utah experienced its first drop in annual mineral production since 1963. The 1967 figure was lower than that of any year since 1957 when the 10-year low, $359.3 million, was recorded.

Because the crippling Kennecott Copper Corp. strike lasted from mid-July 1967 until the end of March 1968, metals production was low for both years.

The 1968 output value in metals was 34 percent higher than that of 1967, but 5 percent lower than that of 1966. The 29 percent decrease in production of metals between 1966 and 1967 was mainly responsible for the drop in mineral output during 1967.

Copper, gold, lead, and zinc production amounted to $171.1 million in 1967, $76.5 million less than the 1966 value. Copper contributed 36 percent to the total value of mineral production in 1967, compared with 43 percent in 1966. All metals (except uranium and vanadium), mineral fuels, and nonmetals showed losses during 1967.

In 1968, however, output and value of nonmetals increased for 10 of the 16 commodities and remained about the same for the other four. Phosphate rock decreased substantially in terms of both output and value. Potassium-salts output increased slightly, but value decreased sharply. Decreases in output and value resulted in a $1.5 million (4 percent) loss for the nonmetals.

The 1968 value of mineral fuels production changed little from that of 1967. Output of natural gas continued to increase in response to a growing demand, but losses were recorded for carbon dioxide. Production of natural gas liquids was up 50 percent, primarily because Union Oil Co.'s Lisbon gasoline plant completed its first full year of operation.

In 1968, new discoveries of crude petroleum failed to offset depletion of older reserves.

Exploratory wells drilled during the first half of 1968 resulted in one oil discovery and 19 dry holes. Sixty more wells were planned for the last half year. If all schedules were met, 1968's total of 80 wells topped the previous year's total by 25.

Sixteen field wells were drilled in the first 6 months of 1968, producing one gas well, six oil wells, and nine dry holes. Forty-one additional wells were forecast by year-end. The total number of field wells planned for 1968 was well under the 85 drilled the previous year. The total amount of drilling anticipated for 1968 fell short of 1967's total by three wells.

Output values of commodities produced in each of Utah's 29 counties in 1966 and 1967 are listed below:

Commodity	1966 Value	1966 Quantity	1967 Value	1967 Quantity
BEAVER COUNTY				
Gold	$ 23,835		$ W[1]	
Silver	217,382		W	
Copper	2,058,507		W	
Lead	7,421		W	
Zinc	4,480		W	
Sand & Gravel	179,000		188,000	
Stone	63,103			
Uranium	W[1]			
Total	$2,578,591		$2,188,944	
BOX ELDER COUNTY				
Petroleum		<½ T42GB[2]		<½ T42GB
Sand & Gravel	$ 589,000		$ 612,000	
Stone	299,077		115,655	
Total	$1,243,578		$1,175,133	
CACHE COUNTY				
Sand & Gravel	$ 220,000		$ 279,000	
Stone	183,422		W	
Total	$ W		$ 516,203	
CARBON COUNTY				
Coal		3,379,907 s.t.[3]		2,971,422 s.t.
Petroleum		2 T42GB		2 T42GB
Sand & Gravel	$ 72,000		$ 65,000	
Uranium				
Total	$21,257,554		$18,630,198	
DAGGETT COUNTY				
Petroleum		5 T42GB		3 T42GB
Sand & Gravel	$ W		$ 51,000	
Stone	1,650			
Total	$ 349,650		$ 331,000	
DAVIS COUNTY				
Sand & Gravel	$1,203,000		$ 363,000	
Stone	9,182		60	
Total	$1,212,182		$ 363,060	

1. W = withheld to avoid disclosing individual company confidential data.
2. T42GB = thousand 42 gallon barrels.
3. s.t. = short tons.

Commodity	1966 Value	1966 Quantity	1967 Value	1967 Quantity
DUCHESNE COUNTY				
Petroleum		145 T42GB		215 T42GB
Sand & Gravel	$ W		$ W	
Stone	15,486		120,906	
Total	$ 756,371		$1,005,351	
EMERY, PIUTE, AND WAYNE COUNTIES				
Uranium	$ 184,582		$ W	
Coal		1,170,402 s.t.		1,113,017 s.t.
Petroleum		16 T42GB		11 T42GB
Sand & Gravel			48,000	
Stone			213	
Total	$6,099,224		$6,112,976	
GARFIELD COUNTY				
Uranium	$ W		$ 92,714	
Petroleum		224 T42GB		432 T42GB
Sand & Gravel	62,000		W	
Stone	70			
Total	$ 769,783		$1,300,489	
GRAND COUNTY				
Uranium	$ 378,148		$ 844,322	
Petroleum		162 T42GB		139 T42GB
Sand & Gravel	23,000		24,000	
Total	$8,311,494		$9,004,385	
IRON COUNTY				
Coal		3,500 s.t.		3,000 s.t.
Sand & Gravel	$ 338,000		$ 287,000	
Stone	1,982		W	
Gold	W			
Silver	W			
Copper	W			
Lead	W			
Zinc	W			
Total	$14,004,961		$12,218,864	

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Commodity	1966 Value	1966 Quantity	1967 Value	1967 Quantity
JUAB COUNTY				
Gold	$ 15,295		$ 16,800	
Silver	34,338		46,145	
Copper	1,845		10,436	
Lead	16,763			
Sand & Gravel	123,000		4,000	
Stone	W		W	
Uranium	W			
Total	$1,509,223		$1,208,994	
KANE COUNTY				
Coal		1,719 s.t.		2,117 s.t.
Sand & Gravel	$ 59,000		$ 50,000	
Stone	70			
Total	$ 68,837		$ 55,823	
MILLARD COUNTY				
Sand & Gravel	$ 20,000		$ 15,000	
Stone			90	
Gold				
Silver	3			
Lead	60			
Zinc	87			
Total	$ 20,150		$ W	
MORGAN COUNTY				
Sand & Gravel	$ 169,000		$ 113,000	
Stone	837,607		W	
Total	$ W		$ W	
PIUTE COUNTY				
Gold	$ W		$ W	
Silver	W		W	
Copper	W		W	
Lead	W		W	
Zinc	W		W	
Uranium	W		W	
Total	$ 586,639		$ 358,162	
RICH COUNTY				
Sand & Gravel	$ 41,000		$ 27,000	
Stone	1,102		5,625	
Total	$ W		$ W	
SALT LAKE COUNTY				
Gold	$ 13,046,670		$ 7,715,365	
Silver	5,179,098		4,163,342	
Copper	188,426,385		125,835,252	
Lead	7,791,828		7,097,916	
Zinc	4,518,302		3,805,039	
Sand & Gravel	4,695,000		3,114,000	
Stone	341,002		W	
Total	$251,156,406		$171,873,213	
SAN JUAN COUNTY				
Silver	$ 1,283		$ 936	
Copper	485,618		393,995	
Uranium	4,550,242		8,945,104	
Petroleum		15,948 T42GB		15,304 T42GB
Sand & Gravel	148,000		20,000	
Stone	41,154		4,443	
Total	$58,320,958		$56,513,155	
SANPETE COUNTY				
Sand & Gravel	$ 125,000		$ 46,000	
Gold	W			
Silver	W			
Copper	W			
Lead	W			
Zinc	W			
Stone	2,400			
Total	$ 215,216		$ 121,531	

Commodity	1966 Value	1966 Quantity	1967 Value	1967 Quantity
SEVIER COUNTY				
Gold			$ 35	
Silver			2	
Coal		64,739 s.t.		72,255 s..t
Sand & Gravel	94,000		106,000	
Total	$1,265,072		$1,366,125	
SUMMIT COUNTY				
Gold	$ 70,840		$ 43,190	
Silver	652,661		481,196	
Copper	113,538		66,475	
Lead	1,688,905		1,164,730	
Zinc	1,920,540		1,367,038	
Coal		15,063 s.t.		13,446 s.t.
Petroleum		241 T42GB		861 T42GB
Sand & Gravel	865,000		53,000	
Stone	65,988		74,367	
Total	$6,163,526		$5,685,055	
TOOELE COUNTY				
Gold	$ 70,840		$ 5,390	
Silver	652,661		365,798	
Copper	194,667		136,123	
Lead	926,958		963,424	
Zinc	632,678		602,904	
Sand & Gravel	615,000		524,000	
Stone	845,717		W	
Total	$8,408,685		$8,147,164	
UINTAH COUNTY				
Petroleum		7,368 T42GB		7,081 T42GB
Sand & Gravel	$ 428,000		$ 311,000	
Stone	600			
Total	$29,604,838		$27,612,152	
UTAH COUNTY				
Gold	$ W		$ W	
Silver	W		W	
Copper	W		W	
Lead	W		W	
Zinc	W		W	
Sand & Gravel	1,895,000		1,169,000	
Stone	W		W	
Total	$14,948,000		$10,854,987	
WASATCH COUNTY				
Gold	$2,155,825		$2,274,580	
Silver	858,401		856,683	
Copper	668,964		655,002	
Lead	1,895,209		1,588,650	
Zinc	1,359,907		1,332,846	
Sand & Gravel	W		90,000	
Stone	W		4,880	
Total	$6,965,546		$6,802,641	
WASHINGTON COUNTY				
Silver			$ 5,704	
Copper			612	
Petroleum		1 T42GB		1 T42GB
Sand & Gravel	$ 177,000		396,000	
Stone	W		3,134	
Total	$ 183,196		$ 405,450	
WAYNE COUNTY				
Sand & Gravel			$ 32,000	
Stone			214	
Uranium			W	
Total			$ W	
WEBER COUNTY				
Sand & Gravel	$ 636,000		$ 457,000	
Stone	44,060		2,345	
Total	$ W		$ W	

GSA—8 FIELD TRIPS TO PUNCTUATE MAY MEET

The Rocky Mountain Section of the Geological Society of America will hold its annual meetings and field trips May 7-10 in Salt Lake City, Utah.

Field trips planned include: *Tintic Mining District,* May 7, guides, T. S. Lovering, H. T. Morris;

Structural Geology of Northern Wasatch Range, May 7, guides, A. J. Eardley, M. D. Crittenden;

Geology of Wasatch Front, May 7, guides, R. E. Marsell, H. C. Lambert, Roger B. Morrison, Richard Van Horn;

Bingham Canyon Mining District, May 10, guides, Allen H. James, Wilbur H. Smith;

Paleozoic Stratigraphy of North-Central Utah as Typified in the Lakeside Range, May 10, guides, William T. Stokes, Hellmut H. Doelling, James H. Madsen, Jr.;

Great Salt Lake Boat Trip and Antelope Island, May 10, guides, Ted Arnow, R. E. Marsell, J. H. Feth, Richard Van Horn, J. W. Hood, M. D. Crittenden;

The Utah Survey reminds those planning field work in Utah in 1969 to advise the UG&MS of their areas of interest, in order that information may be included in the May issue of the *Quarterly Review.*

Engineering Geology and Landslides, May 10, guide, William T. Parry.

Arrangements can be made with Western Rivers Expeditions to join a float trip on the Green River through Split Mountain, May 11, guides, W. F. Scott, Arthur S. Gallenson.

About 500 geologists are expected to attend the meetings and trips.

William Lee Stokes, chairman of the meetings, is being assisted by Kenneth L. Cook. Both professors are staff members of the Department of Geological and Geophysical Sciences, University of Utah.

The Utah Geological and Mineralogical Survey is preparing a GSA *Guidebook to Northern Utah* (Bulletin 82).

The bulletin, designed to supplement the GSA field trips, can be purchased for $4 at the UG&MS office, 103 Utah Geological Survey Building, University of Utah, after April 28.

SHAKE RATTLE 'N' ROLL

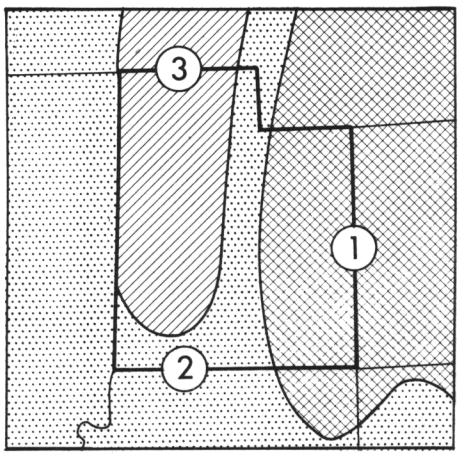
Beehive State Has Its Faults

Just released, the new seismic risk map for the coterminous U.S. places a portion of Utah in Zone 3 (most hazardous) for the first time.

The map was prepared by research geophysicists in the Environmental Sciences Service Administration (ESSA). The original map long has been incorporated in the Uniform Building Code published by the International Conference of Building Officials in Pasadena, California.

Four zones again are used to illustrate the degree to which areas in the U.S. currently are considered vulnerable to damaging earth tremors. Of course, the map is subject to further revision.

Approximately 43 percent of the State is placed in Zone 3 (major destructive earthquakes likely); 26 percent falls in Zone 2 (moderate damage likely); and 31 percent of the State in Zone 1 (minor damage likely).



None of Utah has been placed in Zone 0, which includes areas where earthquake damage is not expected to occur. Formerly, the entire State was located in Zone 2. The new map has revised the classification of three-fourths of Utah.

According to Dr. S. T. Algermissen who heads this C&GS project, general risk prediction has three main objectives:

—providing information which may be used to re-establish, or update, design criteria for earthquake-resistant structures, such as buildings, dams, and bridges;

—providing information useful in planning land use on a very broad scale;

—constructing a seismotectonic map. This involves establishing the variation of earthquake occurrences in the U.S., based on both historical accounts of earthquakes and earth movements that have left visible traces in the form of geologic faults and other topographic changes.

Vulnerability to earth tremors is one aspect of environmental geology included by the UG&MS's Engineering Geology Division in its studies of an area for planning purposes.

For example, evidence of relatively recent major damaging earthquakes was observed in the vicinity of Bear Lake, Utah, last summer.

The Wasatch Fault which borders Zone 3 on the east in Utah — and along which some 85 percent of Utah's population lives — is under continual investigation.

Brine Tests Fix Trace Elements

Among trace elements in Great Salt Lake brines rarely measured quantitatively, but recorded in UG&MS files, are iodine, rubidium, and strontium.

The following results were obtained by a major chemical company.

Iodine (ppm) — 2.3; 2.5; 2.7; 2.7

Rubidium (ppm) — 10; 8

Strontium (ppm) — 6; 4

Rubidium, understood to be the subject of considerable corporate research, finds minor usage in radio and photo cells.

A fourth element, cesium, has been reported to be present in the brines in less than 10 parts per million.

QUARTERLY REVIEW

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University of Utah .....*James C. Fletcher President*
College of Mines & Mineral Industries .....*George R. Hill Dean*
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